DO TECHNOLOGY STUDENTS DEVELOP ETHICAL STANDARDS?

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This article is concerned with the abilities of undergraduates of different academic disciplines to anticipate the social consequences of computer crime. It was found that students from engineering and computer science courses (ECS) were less able to anticipate what resulted from computer crimes, in social terms, than those from other disciplines. Bearing in mind that the people concerned were in their first years at university, it seems that their apparent ignorance of these social variables relates to previous, childhood experiences rather than the results of socialisation at university. This leads us to the conclusion that some, at least, may have chosen non-social subjects to study to avoid the difficulty of dealing with people.

INTRODUCTION

Various departments of computer science, in universities, have developed educational modules on social issues which are orientated towards giving students a liberal education. Some universities realise, perhaps, that they may have ethical problems to confront. A number of incidents have occurred, during the last few years, which suggest that universities and, indeed, schools are breeding grounds for both computer criminals and upstanding members of society alike. Chastising first year computer science undergraduates, who are known to be involved in hacking, for example, can be seen to be ineffectual. (The term hacking is used, in the contemporary sense, to refer to intrusion into others' computer systems without their prior permission.) However, in teaching students about relatively abstract phenomena which are devoid of life-related considerations, are we only compounding an existing problem? Do people, who choose to work with machines rather than with people, have the seed of computer crime in them which is awaiting the right conditions to develop? The study, reported here, confronts the issue of whether the ideal social types of machine--people and people--people are significant in this respect. It also addresses the prospect of people selecting to study technological, machine-based subjects, say, to avoid dealing with people in their later careers.

METHODOLOGY

Small unidisciplinary groups of students received a standard visiting lecture, on non-professional practices in computing, based on the content of a previous paper of the writer (see Coldwell, 1987). These lectures were given in four different tertiary institutes in the states of Victoria and New South Wales in Australia. The majority of these students were studying their first year of computing. Following the lectures, the students were encouraged to ask questions before they voted, individually, regarding various issues. The relevant issue, vis-a-vis the earlier study was whether hacking was considered to be unethical activity. The results of this study (see Coldwell, 1990) indicated that students from the physical sciences (i.e. mathematics, physics and computer science) were less likely to consider hacking to be an unethical activity than students from other disciplines. It did not, however, test whether they were aware what social consequences might result from computer crime.

Following the original study, the students were examined by a written examination paper which included a question that asked them to list five social consequences of computer crime. The question was given to assess whether they were able to anticipate the social consequences of their actions as professionals. The results have been prepared as a contingency table in this paper to assess whether the performances of students from machine-based and people-based academic disciplines differed in this respect.

RESULTS

From the contingency table, we can see, by comparing the responses of engineering and computer science students (ECS) with those from other disciplines, that 29.25 per cent of those students could only give less than four (i.e. &lt;/4) social consequences of computer crime compared with only 5 per cent of the other students. At the top end of the scale, only 51.99 per cent of the ECS students gained a perfect score (i.e. &gt;3) compared with 75 per cent of the other students. These results have a statistical significance which enables us to accept that there is a distinct difference between the performance of students from machine-based disciplines and those from people-based disciplines in this respect.
Scores of students concerning the social consequences of computer crime.

<table>
<thead>
<tr>
<th>SCORES OF STUDENTS</th>
<th>ENGINEERING &amp; COMPUTER SCIENCE COURSES</th>
<th>OTHER COURSES</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>No %</td>
<td>No %</td>
<td>No %</td>
</tr>
<tr>
<td>&lt;4</td>
<td>31 (29.25)</td>
<td>2 (5)</td>
<td>33 (22.6)</td>
</tr>
<tr>
<td></td>
<td>23.96</td>
<td>9.04</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>20 (18.87)</td>
<td>8 (20)</td>
<td>28 (19.2)</td>
</tr>
<tr>
<td></td>
<td>20.33</td>
<td>7.67</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>55 (51.88)</td>
<td>30 (75)</td>
<td>85 (58.2)</td>
</tr>
<tr>
<td></td>
<td>61.71</td>
<td>23.29</td>
<td></td>
</tr>
<tr>
<td>Totals</td>
<td>106 (100)</td>
<td>40 (100)</td>
<td>146 (100)</td>
</tr>
</tbody>
</table>

Note: χ²=10.22 for 2-degrees of freedom at 2.5% = 7.378. H₀ is independent and similarity is rejected.

DISCUSSION
McIntosh (1972) discussed the organisation of crime but made no reference to computer crime. Further, Mukherjee (1981) makes no reference to computer crime nor, indeed, to the general computerisation of criminal activity although computer crime commenced, in real terms, in Italy in the early 1970s! Eysenck (1977), who discussed the personalities of criminals generally, gives us little guidance to the relative distribution of criminals amongst the different occupational, professional or disciplinary groups. Clifford and Gokhale (1979) give us a summary of computer-based innovations in criminal justice but, alas, there can be found few references in criminological literature, to research into technological innovations in the criminal world. Elsewhere, Clifford (1976, 1982), in discussing presentation and evaluation in the criminal system, ignores high-tech crime. Regarding Green's (1969) expectations of the students from technological universities, he refers to the lack of professional ethics on technological courses. Later, Katz and Hartnett (1976), discussing the creation of scholars, give us no further indication of change regarding the relative ethical standards of undergraduate courses for different academic disciplines. However, speaking of the psychometric profiles of computer criminals, Watson-Munro (1986) highlights their inability, in the real world, to deal with their social environment in times of stress. Boquai (1987), although discussing the subject in criminological terms, does not substantiate his opinions suitably nor does he refer adequately to current research on the topic.

In the light of the lack of any research into the awareness of technologists of the social consequences of their work, how do we view the results of this current study? Clearly, students from the technological disciplines do not consider hacking into other people's computer systems to be unethical. Neither do they seem to be as aware of the social consequences of computer crime, apparently, as students of other academic disciplines. Some academic departments of computer science include socially-orientated modules amidst their machine-orientated ones in undergraduate courses. Like engineering students, these undergraduates are now subjected to socially-orientated course modules. The RMIT Handbook (1986), for example, indicates that there are various subject areas, on their undergraduate computer science course, which attempt to develop undergraduate students' awareness of their apparent social responsibility. However, there is some doubt, in the mind of the writer, whether these modules would have any real impact on undergraduates of machine-related disciplines anyway. Their socialisation process follows their earlier impact with early childhood socialisation when they may have developed anti-social attitudes and, perhaps, pro-machine withdrawal responses. As one computer science student put it so aptly, 'I'm not much good with people, so computers seem to be a good logical substitute'. Another, in describing his feelings about the technological power that he possesses, spoke of '... getting my own back on the society that's screwed me up'. These could hardly be considered to be isolated comments and, with more covert ones, suggested that students, who decide to study computer science in particular, are often shy, retiring, withdrawing types alluded to by Eysenck (1977).

In seeking some guidance regarding the development of ethics in early childhood, we have to consider the development of opinion throughout the last few decades in social science theory. Krech et al. (1962) discuss the forming of group ideologies and suggest that the forming of an ethical code is one of the later phases of a group's ideological development. Discussing what is generally accepted as deviant behavior, we find, that even when it is not much acceptable as a norm within certain groups, Johnson (1986) developed an argument concerning the relative power-bases of the different professions although, considering the means by which they attained this, he maintained a utilitarian stance. Parsons (1970) outlines, in abstract, a model which seems to be related to cases like that of the computer science discipline whereby hacking seems to be an acceptable activity. Meanwhile Musgrave (1975) discusses the socialisation of children, both in the family and at school, and outlines how socialisation occurs but does not develop an argument for differential socialisation and, further, does not conceive of those people, who it affects, least, forming a deviant group and seeking a similar occupation (e.g. computer scientists) or career path. Clarizio et al. (1970), by comparison, discuss the eccentric development of gifted children and, if we can conceive of children with a similar disinterest in people choosing a similar occupation to work with machines, we can conceptualise and, perhaps, explain how machine-people and people-people might occur.

We might argue that children who are taught by dogma and learn by rote have little inclination or, indeed, opportunity to develop their own moral values. Could we even consider whether dogma-based religions correlate well with the possession of machine-people characteristics? Bear in mind, here, that the origins of computer crime were in Italy although it has since spread worldwide. (At the time of writing, the computer virus being discussed in the press is called...
Michelangelo! Would such children be more inclined to excel in the mathematically-orientated, physical sciences and move into a career in computerscienceengineering? Might they fit the pattern portrayed above (see Watson-Munro, 1986) and respond to a question regarding the social consequences of computer crime in the way that the ECS subjects did? Indeed, Laycock (1972) refers to the problems with development of such gifted children but it would be rash, however, to extend this system of classification to other occupants as an apparent dichotomy. It might, however, be used more usefully to form the two ends of a continuum related to machine-people and people-people which may be considered useful social ideal types.

CONCLUSIONS

It is difficult to say what we can conclude from these findings due to the exploratory nature of the investigation. However, it has become apparent that physical science students are the least concerned about ethical standards related to their field. This may, in fact, suggest that these people chose their field, in the first place, because they were previously asocial. If their orientation that way preceded tertiary education, it may have had one of various contributory causes. It would be amusing to ponder on the psychological testing of applicants for undergraduate courses in machine-based disciplines.

Clearly, society has a need for people to fill occupational roles where they can make decisions scientifically and objectively without considering social phenomena. (Oppenheimer’s politically and militarily supported development of the atomic bomb falls within the scope of this reference as, perhaps, does Speer’s apparently ingenious design of gas chambers in Nazi Germany.) Society seems to have an awesome responsibility for policing both occupational groups and, in particular, professions and, in the case of computer science, of young new professions. Meanwhile, it is difficult to appreciate how the world will survive computer science passing through its puberty. Whereas it would be unfair to label it a delinquent discipline, we can be excused — vis-a-vis its current ethical standpoint — for feeling apprehensive about the early development of a profession which, effectively, controls the information flow of the globe and, perhaps, other globes within the near future.

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